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EVOLUTION OF TRACE GASES AND AEROSOLS IN THE MEXICO CITY POLLUTION OUTFLOW DURING A LONG RANGE TRANSPORT EVENT

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ABSTRACT

Significant chemical and physical processing of the Mexico City (MC) pollutants is expected to occur as they are advected downwind over a period of several hours to days. Of particular interest are the formation and evolution of ozone and primary/secondary aerosols due to their implications for regional air quality and climate. We report here on the long-range transport episode of March 18-19, 2006, which was successfully characterized by the Controlled Meteorological (CMET) balloon trajectories in the MC outflow over a period of 26 hours. The key tool in our analysis of the various gas-aerosol processes is the new Model for Simulating Aerosol Interactions and Chemistry (MOSAIC), which is applied here in a Lagrangian box-model framework. Comprehensive G1 aircraft measurements of key trace gases and aerosols made just downwind of MC (over the T2 site) are used to initialize the model, while the C130 aircraft measurements made in the same air mass after one day (~450 km downwind) are used to constrain and evaluate the model. Results suggest that significant dilution (~6 % per hour) and photochemical ozone production occurred in the MC outflow. Particulate ammonium nitrate, which constituted a significant fraction of the sub-micron aerosol mass just downwind of MC, almost completely evaporated after one day due to dilution and formation of additional ammonium sulfate. Model calculations also suggest that the evaporated nitric acid re-condenses on the super-micron dust particles to form hygroscopic calcium nitrate. Furthermore, the observed organic aerosol/CO ratio after one day is nearly twice that of the modeled ratio, which suggests continued secondary organic aerosol (SOA) production during the long range transport event. Implications of these results on the downwind air quality and climate-affecting properties of the MC pollutants will be discussed.
